

Running Head: PUBLIC EDUCATION TO DECREASE DROWNING

Feasibility of Public Education as a Means of Decreasing
Risk of Drowning in Wake County, NC

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Certification Statement

I hereby certify that this paper constitutes my own product, that where language of others is set forth, quotation marks so indicate, and the appropriate credit given where I used language, ideas, expressions, or writings of another.

Signed: _____

Abstract

The problem facing Wake County is that as the population increases, as projected (Wake County 2008), over the next decade, the number of drownings will proportionally increase. The purpose of this research was to identify trends related to drowning accidents in Wake County and make recommendation on how best to reduce the number of drownings based on what other agencies have implemented. The use of descriptive methods of research was utilized to answer the following five research questions: Compared to the national average, is the number of drownings in Wake County statistically significant? What were the factors that led to the thirty-eight drownings in Wake County during the referenced period? How could those events have been prevented? How effective have other programs been to reduce the number of drownings? A literature review was performed to determine how other communities have addressed the same problem Wake County is experiencing with regard to drownings. A report containing the number of drownings in Wake County was evaluated to discover the severity of the problem. Those results were then compared to those on the national level using statistical tests, including the Pearson correlation coefficients test and two-tailed t-tests. Results found that Wake County did have a higher rate of drownings over the national rate, per 100,000 people. The water source of drownings in the County varied by age groups; however, overall, public pools had the highest reported drowning and people in the age group of 5 to 14 experienced the highest rate of drowning. These results were inconsistent with national reports. Based on the results of this research, Wake County could decrease drownings by implementing multifaceted campaigns tailored to the different age groups and their specific needs.

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Introduction

Wake County, North Carolina is located between the Piedmont uplands and the Coastal Plain. It consists of twelve municipalities that include Apex, Wake Forest, Holly Springs, Garner, Zebulon, Cary, Wendell, Morrisville, Knightsdale, Rolesville, Fuquay-Varina and Willow Springs. The population of the County for 2009 is an estimated 902, 689. Projections by the Wake County Planning Department suggest the population will exceed one million by 2012 (Wake County, 2008, see also United States Census Bureau, 2007).

Wake County has a moderate climate, which consists of long spring, summer and fall seasons and a relatively short winter. Temperatures can reach about 90 degrees Fahrenheit during the summer, although the average temperature year round is 73 degrees Fahrenheit (Wake County, 2008), which makes for a long pool and natural water season. According to Wake County Environmental Services, there are currently 1,006 public pools in operation in Wake County (Wake County, "2009 Pool List"). Outdoor public pools generally open in May near Memorial Day and close in September, after Labor Day, which allows approximately four months of prime pool utilization. While this period may bring enjoyment to many children, it also ushers in a busy time for the fire service and Emergency Medical Service (EMS).

Between January 1, 2008 and July 3, 2009, EMS agencies serving Wake County responded to thirty-eight calls referencing drowning (Appendix A). The water source of the drownings ranged from toilet, tub, residential pool, natural bodies of water and public pool. Public pool responses were the greatest at fourteen, natural bodies of water next at thirteen, residential pools at eight, two tub accidents and one toilet submersion (Wake County EMS "Narrative Report", 2009).

The term "drowning" is commonly associated only when death occurs from submersion in a liquid. Dorland's Medical Dictionary defines drowning as "suffocation and death resulting from filling of the lungs with water or other substance." World Health Organization defines drowning as "the process of experiencing respiratory impairment from submersion/immersion in liquid" (Van Beeck EF, Branche CM, Szpilman D, Modell JH, Bierens 2005). For the purpose of this applied research project (APR), the definition of drowning is "the process of experiencing respiratory impairment from submersion or immersion in liquid, regardless of whether death occurred."

The problem is as the population increases over the next decade, the number of drownings will increase in direct correlation with the number of new pools that will be constructed or utilized to support this growth and the increase in the number of people who will be partaking in natural water recreational activities. The purpose of this research was to identify trends related to drowning accidents in Wake County and make recommendations for an intervention that will help reduce the number of drownings. It is inferred by this researcher that the prevalence of drownings in the County, without intervention, will continue to rise with the increasing population. The Wake County Fire Service is charged with the duty of facilitating public safety and the goal of this research is to provide them with the information necessary to implement programs aimed at reducing the incidence of drowning by 25% by the end of the year 2012.

The use of descriptive methods of research will answer the following five research questions. Compared to the national average, is the number of drownings in Wake County statistically significant? What were the factors that led to the thirty-eight drownings Wake County EMS agencies responded to between January 1, 2008 and July 3, 2009? How could

those events been changed to prevent the drowning? How effective have the programs that other fire departments have implemented been to prevent drowning? Based on the findings from the previous four questions, what would be the most effective means to decrease the rate drowning in Wake County by at least 25% by 2012?

Background and Significance

Wake County is 860 square miles and ranks seventh in growth in the nation (Wake County, 2008). This growth correlates to approximately 100 people moving into the County each day. The median age is estimated at 34.5 years; however, 26.1% (217,455) of the population of Wake County includes children under the age of 18 (Wake County, 2008, see also United States Census Bureau, 2007). If this trend in growth continues as predicted, by the year 2012, the number of children under the age of 18 living in Wake County will be 266,063.

In 2006, there were 3,579 fatal unintentional drownings in the United States, averaging ten deaths per day, which ranked drowning sixth in the top ten cause of death related to unintentional injury in the nation (Appendix B). In the same year, there were another 4,842 non-fatal drownings reported by the Centers for Disease Control and Prevention, National Center for Injury Prevention and Control through the Web-based Injury Statistics Query and Reporting System (CDC, WISQARS, 2009).

Based on the rates of fatal and non-fatal unintentional drownings reported in the United States in 2006, (CDC, Water-related injuries: CDC activities, 2008; see also CDC, Water-related injuries: fact sheet, 2008), which are the most current available, the crude rate was 2.82 per 100,000 people (Table 1). In comparison, Wake County's 2008 population was 868, 121 (Wake County Health Report, 2008) and in the same year, there were 28 drowning calls, or 3.2 per

100,000 people (Table 2). The number of drownings in Wake County surpasses the United States average, which shows a significant need for intervention.

Table 1.

**2006, United States
Fatal and Non-Fatal Unintentional Drowning
All Races, Both Sexes, All Ages**

	Number of Reports	Population	Crude Rate per 100,000
Fatal Drownings	3,579	298,754,819	1.20
Non-Fatal Drownings	4,842	298,754,819	1.62
Combined	8,421	298,754,819	2.82

Table 2.

**2008, Wake County Unintentional Drowning
All Races, Both Sexes, All Ages**

	Number of Reports	Population	Crude Rate per 100,000
Unintentional Drownings	28	868,121	3.2

As of June 2009, there were 1,006 public pools in Wake County (Wake County Environmental Services, "2009 pool list"). That equates to approximately 216 children per pool. With the increase of nearly 50,000 children by 2012, the number of pools may subsequently increase or crowding in public pools may result. Either scenario poses an increased risk of unintentional injury by drowning.

Natural or open bodies of water located in Wake County consist of lakes, rivers, creeks and ponds. Many of these offer recreational activities, including swimming, boating, kayaking, skiing, ice skating and fishing. As the population increases, the number of people participating in these activities should show a parallel increase, which may also contribute to an increase in the number of unintentional injuries related to drowning.

This ARP coincides with the Executive Analysis of Community Risk Reduction (EACRR) course offered through the United States Fire Administration's (USFA) National Fire Academy (NFA) Executive Fire Officer Program (EFOP) (National Fire Academy 2008). The intent of the course is to establish a national focus on community risk reduction. The purpose of this ARP is to work toward reducing the incidence of drowning in Wake County, North Carolina as a satisfaction of the intent of the EACRR. Specifically, this ARP coincides with the five units that are a part of the curriculum of the EACCR:

Unit 1: The Executive Fire Officer: A Community Risk Reduction Strategist seeks to enable students to compare and contrast community risks and explain levels of risk prevention, which relates to this research in comparing and contrasting drowning rates locally against national rates. This research also will explain in detail the levels of risk prevention.

Unit 2: Assessing Community Risk has the goal of enabling students to develop risk reduction objectives, which is presented in the ARP through processing the data collected and establishing priorities based on the identified risk of drowning and what is an acceptable level of risk for Wake County.

Unit 3: Intervention, Program Design, and Evaluation teaches students the necessary tools to design a plan for a local risk reduction initiative through identifying, justifying and applying strategies. It also guides the student to monitor objectives and report findings, which will be an integral part of the ARP as it relates to presenting the results of this research on drownings.

Unit 4: Leading Organizational and Community Change was presented to prepare the student for applying a change to a new or existing community risk reduction initiative. The ARP will utilize this information to develop a strategy for leading change to reduce the number of drownings in Wake County.

Unit 5: Organizational and Community Politics was presented to teach the student how to develop and implement a strategy for changing local policy regarding a pertinent community risk reduction issue. This research will utilize the information from this unit to make recommendations for the implementation of new local policy aimed at reducing the number of local drownings.

The USFA has developed the following operational objectives issues (United States Fire Administration [USFA], 2002):

- reduce by 25 percent the loss of life of the age group 14 years old and below;
- reduce by 25 percent the loss of life of the age group 65 years old and above;
- reduce by 25 percent the loss of life of firefighters
- 2,500 communities will have a comprehensive multi-hazard risk reduction plan led by or including the local fire service, and
- to appropriately respond in a timely manner to emergent issues.

By reducing the incidence of drowning in Wake County by 25% by 2012, this research will have an impact on the reduction of the loss of life in children aged 14 and under, which is the first objective. It may subsequently affect the loss of life in the age group of 65 years and older, but by a less significant percentage, which is the second objective. By implementing a program designed to reduce drowning, Wake County's fire service will be leading a multi-hazard reduction plan, which adds to the car-safety and seat installation and fire prevention programs already in place, which is the fourth objective. The successful implementation of a drowning prevention program in Wake County will help the USFA move closer to reaching its operational objectives.

Literature Review

A literature review is included to summarize the findings of other research conducted that relates to different aspects of drowning and drowning prevention. This review will focus on discovering possible solutions to Wake County's problem of statistically high drowning rates by reviewing what other researchers have found effective. The literature review will seek to answer two questions. Are the demographics of drownings in Wake County the same across the nation? What have other communities and agencies found successful in reducing the incidence of drowning?

There is a multitude of research conducted on the significance of drownings in the United States. The CDC provides the most comprehensive information available using WISQARS database provided on their website. In 2006, the CDC listed drowning as the sixth leading cause of unintentional death in the United States across all races, both genders, and all ages (Appendices B, C) (CDC, 2008).

L. Quan and P. Cummings researched the characteristics of drowning victims and their drowning incidents obtained from death certificates, medical examiner, pre-hospital, emergency department, and hospital records to quantify the information based on age groups. They studied three counties in Western Washington. The subjects of their study were 709 victims of unintentional drowning during 1980 through 1995. This research also categorized, by age, the events that led to the drowning and the location of drowning (source of water). This information was grouped by boating, including fishing from a boat; swimming or diving, occupant of a car that went into the water; fell into water from a dock or from shore or while wading; bathing. The source of water was categorized as swimming pool; bathtub; open water, an outside body of water other than a swimming pool, such as a lake, river, or pond (2003).

Their research found that 72% of all drownings were in open water. Among victims 15-35 years, greater than 90% of the drowning occurred in open water. Children 0-4 years, had rates that were nearly equally distributed between swimming pools and open water. Among those older than 65 years, 57% of drownings occurred in bathtubs. Bathtub drowning rates were highest (11 per million) among those over 65 years and those younger than 5 years (Quan, Cummings, 2003).

According to their research, the majority (74%) of those 0-4 years fell into a body of water and almost all other children in that age group (24%) drowned while bathing. Between the ages of 5 and 34 years, most drownings were associated with either boating (26%) or swimming (29%). Teenagers 15-19 years had the highest rates for drowning while swimming, boating, or driving a car (9, 8, and 3 per million respectively). The majority (57%) of those over 65 years drowned while bathing. Boating was the pre-drowning event in 20% of all drownings and was the most common pre-drowning activity among victims 15-64 years (Quan, Cummings, 2003).

Quan and Cumming's research found that drowning in open water was the major site of drowning and greater effort should focus on increasing life vest use for boaters since boating was a common activity in those aged 15-64 years. They also discovered the highest use of alcohol, 28%, was in those aged 15-35 years and multiple approaches, in addition to a focus on alcohol use, are necessary to prevent drowning while swimming and boating in this age groups. Seizure disorder history was present in all age groups (range 4%-16%). They recommend that children and adults with a history of seizures should shower rather bathe in a tub (2003).

In summary, Quan and Cummings' research found that victims' characteristics, pre-existing health conditions, activities, location of drowning, and use of medical resources vary with age. Therefore, different strategies to prevent drowning are necessary for each age group (2003).

Another researcher reported that drowning is the second leading cause of unintentional injury death among children ages 1 to 19 years (Brenner, Trumble, Smith, Kessler, Overpeck, 2001). Their research sought to provide national data about the specific sites of drowning among United States children and to examine site-specific drowning rates by age, race, and gender, since that information was not readily available.

Death certificates were obtained for 1,420 unintentional drownings among children less than 20 years of age in 1995. They examined proportional distributions of the site of drowning by age, region, gender, and race and calculated the drowning rates by age, race, and gender. The site of drowning was specified on 1,308 (92%) of the death certificates. They found that fifty-five percent of infant drownings were in bathtubs. Children between the ages of 1 to 4 years drowned in artificial pools (56%) and in other bodies of freshwater (26%). Sixty-three percent of drownings in older children occurred in natural bodies of freshwater (Brenner et al. 2001). Site-

specific drowning rates varied by race and gender, however racial and gender disparities are not a focus of this APR and will not be included in this literature review, although it was a component of this research by Brenner, et al.

Of the death certificates reviewed, 37% percent of drowning victims were between one and 4 years of age, and 29% were between 15 and 19 years of age. Among the 1,420 drowning deaths 669 (47%) occurred in freshwater and 457 (32%) were in artificial pools. Domestic sites, such as bathtubs, accounted for 125 (9%) deaths, and 57 (4%) drownings were in salt water. Seventy-eight percent of drownings in infants occurred in the home, with 71% of those in bathtubs and 16% in buckets. Children between the ages of 1 and 4 years were most likely to drown in artificial pools. Freshwater drownings accounted for 22% and 36% of drownings amount 1 to 2 and 3 to 4 year-olds, respectively. They found that after the age of 5 years, children were most likely to drown in freshwater: 5 to 9 years (54%), 10 to 14 years (61%), and 15 to 19 years (69%) (Brenner, et al, 2001).

Brenner et al. suggests that topics for preventive counseling should include: constant supervision of infants and young children when they are in the bathtub or around other bodies of water; installation of isolation fencing that separates the pool from the house for homes with pools; and use of personal flotation devices when riding on a boat or playing near a river, lake, or ocean. They also stress the importance of teaching children never to swim alone or without adult supervision; the dangers of alcohol and drug consumption during aquatic activities; and the need for parents and teens to learn cardiopulmonary resuscitation (2001).

Brenner asserts that drowning is a leading cause of injury-related death in children. In 2000, more than 1,400 US children less than 20 years old drowned. Ninety-one percent of those deaths were unintentional and not related to boating. They found that for each drowning death, 1

to 4 children suffer a serious nonfatal submersion event, many of which leave children with permanent disabilities. Environmental strategies, such as installation of 4-sided fences around swimming pools, and behavioral strategies, such as increased supervision of children while around water, are necessary to prevent these incidents (Brenner 2001).

A review of previous ARPs was conducted to reveal the recommendations based on their research as it related to drownings. An ARP was discovered titled *Sink or Swim: Is St. Petersburg Fire & Rescue Doing All They Can to Prevent Drowning?* that revealed the city was in need of drowning intervention. The author, S. Knight recommended numerous programs, such as increased media attention, school intervention, post-discharge hospital education, canvassing, and events (Knight S. 2007).

Another ARP, authored by J. Lorber, titled *Drowning...The Silent Killer of Children: Should the Fort Lauderdale Fire Rescue Department take a Proactive Approach in the Development of a Prevention Program?* The recommendations made by this ARP was to educate the public about how significant the problem of drowning is in Fort Lauderdale to get them to "buy into" supporting an intervention program. It was also recommended that a uniform approach to reporting be developed to facilitate future research and to monitor trends (Lorber J., 2004).

The Mesa Fire Department in Mesa, Arizona, began a program in 2006 that was aimed at teaching water safety with the goal of reducing the child drowning rate in their jurisdiction. Arizona places second only to Florida for the highest number of drowning cases in the United States (Maricopa County 2007, see also Children's Safety Zone, 2009). As part of the program, according to an interview with Michele Long on September 23, 2009, Mesa Fire Department distributed drowning prevention information and lifeguard whistles door-to-door to roughly

50,000 homes. This mass distribution event was to bring attention to the importance of constant eye-to-eye supervision of children around water (personal communication M. Long September 23, 2009).

There is a lack of standard reporting of drowning incidences across the United States. This has created inconsistencies in the dissemination of information. For example, different researchers pair age categories differently, resulting in classifying drowning in different rankings. An example of this is where Gilchrist et al. lists drowning as the seventh leading cause of unintentional injury deaths in 2001 through 2002 for all ages and the second leading cause of all injury deaths in children aged 1-14 years (Gilchrist, Gotsch, Ryan, 2004). In contrast, for the same year, the CDC ranks drowning as the sixth leading cause of death ([WISQARS], 2009, see also CDC, 2002, CDC 2004, CDC 2006).

Procedures

Procedures used to adequately research information regarding drowning prevention included an in-depth literature review, mathematical calculations, and personal communication. The first step that was taken toward the completion of this ARP was to search the internet for topics relating to drowning statistics and prevention programs. The topic "US drowning statistics" was entered into Google's search engine and it returned *Drowning Prevention* as included in the website for the CDC as the first result. The information obtained from this query proved to be helpful and the most reliable, since the CDC generally has greater access to statistical information than the general public.

After the information was gathered regarding the number of drowning events that took place over a referenced period of time, simple mathematical calculations were used to determine the crude rate of drowning per 100,000 people based on the United States events. Those results

were then compared with the information obtained from Wake County's EMS to determine their crude rate per 100,000 people. This was done by taking the number of incidents and dividing it by the total population.

To evaluate the effectiveness of other programs to prevent drownings, the term "fire department and drowning prevention" was typed into Google's search engine. The query returned 74,300 results. Mesa Fire Department's website was selected and navigated until the water safety section was discovered. From there, viewers are directed to another site for statistics related to drowning.

One limitation in these procedures were the inconsistencies in findings among the sources. This APR used sources that were considered credible, such as the CDC and USFA to ensure accuracy of information when reporting statistics. Another limitation to these procedures was the difficulty in finding information that was categorized consistently. An example is the CDC may group ages into smaller segments, thus giving a different value to the number of drownings that would occur when a larger sample group was used. Another limitation in these procedures is that lack of definitive correlations between the decrease in drownings and the program that was implemented in other areas. Since there was no data available that stated with certainty that implemented drowning programs have decreased drowning, the effectiveness of the programs is assumed.

Results

Descriptive methods of research were used compile information relating to drowning incidents in Wake County, North Carolina. Procedures were formulated to answer the following five research questions? Is the number of drownings in Wake County statistically significant compared to national average? What were the factors that led to the thirty-eight drownings that

Wake County EMS agencies responded to between January 1, 2008 and July 3, 2009? How could those events been changed to prevent the drowning? How effective have the programs been that other fire departments have implemented to prevent drownings? Based on the findings from the previous three questions, what would be the most effective means to decrease the rate drowning in Wake County by at least 25% by 2012?

To determine whether the number of drownings in Wake County was statistically significant compared to the national average, the crude rates from each group were computed. The crude rate of drownings in the United States was obtained from the CDC WISQARS Database. Based on the rates of fatal and non-fatal unintentional drownings reported in the United States in 2006, which are the most current available, the crude rate was 2.82 per 100,000 people (CDC, 2009). In comparison, Wake County's 2008 population was 868, 121 (Wake County, 2008) and in the same year, there were 28 drowning calls (Wake County EMS, 2009), or 3.2 per 100,000 people. The number of drownings in Wake County surpasses the United States average, which shows a significant need for intervention.

To answer the second research question, which seeks to discover the events that preceded the thirty-eight drownings, a thorough history of calls by EMS agencies in Wake County was reviewed (Wake County EMS, 2009). Forty-eight calls that referenced drowning were included in their report, however 10 were not included in this research because they were duplicated reports or upon arrival at the scene, there was no body discovered (dry run). The report included the following information: call date; EMS agency; fire agency; address of call; EMS narrative; disposition code; outcome; age of victim; time of 911 call; EMS time of dispatch; EMS arrival time; fire and rescue arrival time; weight of victim; map codes; time arrived at victim; gender. The water source for the drowning was not categorized in their report; however, the EMS

narratives and the address of the call provided enough information to extrapolate the source.

Where the narrative did not provide enough information to determine the water source, the Wake County GIS was used to cross-reference the address for determination. The information obtained from the report is presented below.

On January 4, 2008, Apex EMS and Cary Fire Department (CFD) were dispatched to multiple drownings at the same address. Personnel were at the patients approximately five minutes after the 911 call was placed. Upon arrival, EMS found three victims who had fallen through thin ice while skating on a pond sitting in front of a fireplace with blankets placed around them. The victims were an 8 year old male, a 10 year old female, and a 10 year old male. All three victims refused treatment and transportation.

On March 29, 2008, Holly Springs Public Safety responded to a call regarding a 39 year old male who had fallen out of a boat while reeling in a fish. He was picked out of the water by a co-fisherman in the same boat after being underwater approximately 10-30 seconds and taken to shore where he shed his wet clothing. Holly Springs Public Safety arrived at the victim approximately 12 minutes after the 911 call was placed and transported him to the emergency department.

Apex EMS and Fairview Fire Department (FFD) were dispatched to a call on April 20, 2008 to find a 59 year old male lying in the back of a boat. The victim stated he was thrown from the boat at a low speed and does not recall how long he was in the water before someone picked him out. EMS arrived approximately 14 minutes after the 911 call was placed and transported the victim to the emergency department for treatment.

On June 6, 2008, Garner EMS and Wake County Sheriff Department arrived at a private residence to find a 55 year old female lying in a supine position on the edge of their pool. Her

husband was administering cardiopulmonary resuscitation (CPR) when EMS arrived, which was approximately 8 ½ minutes after the 911 call was placed. She was transported to the emergency department for treatment of cardiac arrest.

On June 9, 2008, Wake County EMS and Raleigh Fire Department (RFD) were dispatched to a pool drowning. They arrived approximately 10 ½ minutes after the 911 call was placed. They found a 58 year old male dead on arrival (DOA). RFD began CPR and transported the victim to the emergency department for treatment of cardiac arrest.

On June 16, 2008, Eastern Wake EMS and Knightdale Public Safety (KPS) responded to a call referencing drowning in an apartment complex pool. They arrived approximately 4 minutes after the 911 call was placed. The victim was a 4 year old male who was found by his mother floating in approximately four feet of water. He was transported to the emergency department for treatment.

Wake County EMS and RFD were dispatched to a call referencing a lake drowning on June 20, 2008. They arrived 5 minutes after the 911 call was placed by Raleigh Police Department (RPD). The victim was a 24 year old male who was fleeing RPD on a foot chase via the lake and was spotted bobbing in the lake. The victim was DOA.

On June 24, 2008, Six Forks EMS and RFD responded to a drowning call for a 22 month old female. They arrived approximately 9 ½ minutes after the 911 call was placed to find the victim maintaining a clear airway after falling into a public pool. The victim refused transport.

On July 4, 2008, Wake County EMS and RFD responded to a public pool drowning. They arrived at the patient approximately 9 minutes after the 911 call was placed to find a 30 year old female being treated by an off duty EMS professional. Reportedly, the victim lost

consciousness while in the pool, went under water, and was rescued. The victim was transported to the emergency department.

Also on July 4, 2008, Eastern Wake EMS and Hopkins Fire Department responded to a report of a drowning at a residential pool. The response time was approximately 11 minutes from the time the 911 call was placed. They arrived to find a 64 year old male who was found by family member floating in the pool. They reportedly had seen him last 20 minutes prior to finding him in the pool. The patient was unconscious, pulseless and apneic and CPR was ceased.

On July 5, 2008, Six Forks EMS and Bay Leaf Fire Department was dispatched to a report of a drowning in a lake. The victim was a 23 year old male who was found DOA. There is no report of the time lapse between the 911 call and arrival at the victim.

On July 9, Eastern Wake EMS and RFD were dispatched to a report of a multi-victim drowning in a river. They arrived at the victims 32 minutes after the 911 call as placed. A friend of the victims stated that they were swimming and when he looked back, his two friends, both males and both 21 years old, were not behind him anymore. The two victims were found DOA.

On July 20, 2008, Cary EMS and Swift Creek Fire Department was dispatched to a report of a drowning in a lake. They arrived approximately 13 minutes after the 911 call was placed to find a 33 year old female complaining of back pain after diving into shallow water. She denied striking her head on any objects. She was transported to the emergency department.

On July 24, 2009, Wake County EMS and RFD were dispatched to a call at a public pool for a drowning. They arrived 8 minutes later to find a 3 year old male who had fallen into the pool and was injured. He was transported to the emergency department for treatment.

On July 27, 2008, Garner EMS and Garner Fire Department were dispatched to a call referencing drowning at a residential pool. They arrived 10 ½ minutes after the 911 call was

placed to find a 50 year old female who slipped on the steps to the pool and landed hard on her bottom. She was unable to stand without assistance. She was transported to the emergency department.

On July 29, 2008, Wake County EMS and RFD were dispatched to a call referencing drowning at a public pool. They arrived approximately 12 minutes later to find a 23 year old male poolside, suspected of having cardiac arrest. Transport was not reported.

On August 1, 2008, Apex EMS was dispatched to a call referencing drowning at a public pool. EMS arrived 12 minutes after the 911 call was placed to find a 17 year old male who had injured his shin on the edge of the diving board. He was in the presence of lifeguards. He was transported to the emergency department.

Also, on August 1, 2008, Six Forks EMS and Stony Hill Fire Department were dispatched to a call referencing drowning at a lake. They arrived 23 ½ minutes after the 911 call was placed to find a 44 year old male who was reportedly suffering from cardiac arrest. His disposition was not listed.

On August 3, 2008, Garner EMS and Fairview Fire Department were dispatched to a call referencing drowning at a public pool. They arrived 8 ½ minutes after the 911 call was placed to find a 3 year old female who was supervised playing on the pool steps and jumped down a step that was too low and gulped some water. She immediately was removed from the pool and was transported to the emergency department.

On August 4, 2008, Eastern Wake EMS and New Hope Fire Department were dispatched to a call referencing drowning at a residential pool. They arrived 15 minutes after the 911 call was placed to find a 44 year old male who first responders had already placed a C-Collar on. No other details were listed. He was transported to the emergency department.

On August 10, 2008, Wake County EMS and Stony Hill Fire Department were dispatched to a call referencing drowning at a lake. They arrived 14 minutes after the 911 call was placed to find a 19 year old male who had already been removed from the water. CPR was already in progress on their arrival. They placed the victim on a backboard and their initial assessment was cardiac arrest. Disposition was not listed.

On August 12, 2008, Garner EMS was dispatched to a call referencing drowning at a residential pool. They arrived 12 minutes after the 911 call was placed to find a 3 year old female who was found by her caregiver in the pool. She estimates the submersion was approximately three minutes. She was transported to the emergency department.

On August 16, 2008, Six Forks EMS and Bay Lead Fire Department were dispatched to a call referencing drowning at a residential pool. They arrived 13 minutes after the 911 call was placed to find a 19 year old male who was found by this brother. He was reportedly under the water one and a half minutes. Bystanders reported that he was pulseless and apneic and began CPR. EMS ceased CPR.

On November 8, 2008, Wake County EMS and RFD were dispatched to a call referencing drowning in a tub. They arrived 8 ½ minutes after the 911 call was placed to find a 2 year old male who slipped and hit his head in the tub, but was never submerged. This fall was witnessed by the victim's father. He was transported to the emergency department.

On November 22, 2008, Wake County EMS and Wake Forest Fire Department were dispatched to a call referencing drowning at a residential pool. They arrived 6 ½ minutes after the 911 call was placed to find a 2 year old male lying supine on cold concrete next to pool. Victim had cold ambient temperature, no spontaneous respirations, no pulse, and was purple in color. CPR was in progress. No further details were given.

On January 1, 2009, Eastern Wake EMS and RFD were dispatched to a call referencing drowning in a bathtub. They arrived 10 ½ minutes after the 911 call was placed to find an 18 month old male who was found by his mother standing up in the tub gasping for air. The mother stated she was only out of the room for one minute. He was transported to the emergency department.

On February 2, 2009, Wake County EMS and RFD were dispatched to a call referencing drowning at a public pool. They arrived 7 minutes after the 911 call was placed to find a 16 year old male who appeared to be in respiratory arrest. He was transported to the emergency department.

On March 6, 2009, Wake County EMS and Fuquay Fire Department were dispatched to a call referencing drowning at a pond. They arrived 19 minutes after the 911 call was placed to find a 36 year old male clinging to his overturned boat. Victim stated he was fishing in his johnboat, saw a snake in the water, forgot he was in the boat and started running. The boat capsized and the victim was in the cold water until the fire department could get him to shore. He was transported to the emergency department.

On March 15, 2009, Cary EMS and Cary Fire Department were dispatched to a call referencing drowning at a public pool. They arrived 10 minutes after the 911 call was placed to find a 20 year old male who was reported unconscious. The victim's condition was changed to Code Blue while enroute. CPR was ceased and no further details were provided.

On June 6, 2009, Six Forks and Durham Fire Department were dispatched to a call referencing drowning at a residential pool. They arrived 9 ½ minutes after the 911 call was placed to find a 24 year old male who was discovered by this parent's friends. The victim was removed from the water by his parents. He was transported to the emergency department.

On June 8, 2009, Cary EMS and Cary Fire Department were dispatched to a call referencing drowning at a public pool. They arrived 9 ½ minutes after the 911 call was placed to find an 8 year old male sitting in the pool area with no complaints. No further details were provided. He was unable to stand without assistance. She was transported to the emergency department.

On June 10, 2009, Wake County EMS and RFD were dispatched to a call referencing drowning at a public pool. They arrived 5 minutes after the 911 call was placed to find a 6 year old male who beside the pool. Bystanders had begun CPR. He was transported to the emergency department.

On June 11, 2009, Apex EMS was dispatched to a call referencing drowning in a toilet. They arrived 10 minutes after the 911 call was placed to find a 9 month old female in her mother's arms. Mother stated she had left the bathroom for five minutes and when she returned, she found her daughter's head submerged in the toilet. Victim refused transport to the emergency department.

On June 18, 2009, Garner EMS and Garner Fire Department were dispatched to a call referencing drowning at a public pool. They arrived 6 minutes after the 911 call was placed to find a 34 year old male who was struck in the head by someone jumping into the pool. He became disoriented and may have inhaled some water. He was transported to the emergency department.

On July 3, 2009, Wake County EMS and RFD were dispatched to a call referencing drowning at a public pool. They arrived 6 minutes after the 911 call was placed to find a 39 year old male who was discovered by bystanders in the pool and unresponsive. He was transported to the emergency department.

Figure 1.

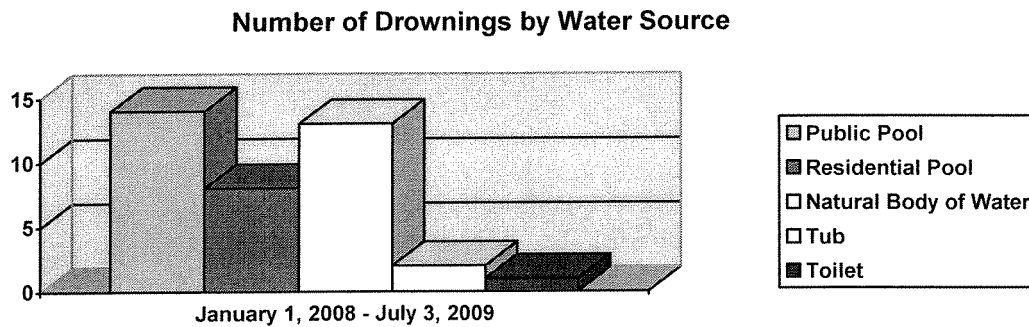


Figure 1 shows that public pools were the source of the majority of drowning calls in Wake County with 14 calls. Following closely was natural bodies of water, which included ponds, lakes and rivers, was next with 13 calls. There were eight calls to residential pools, two for bathtub calls and one for a toilet submersion.

Figure 2.

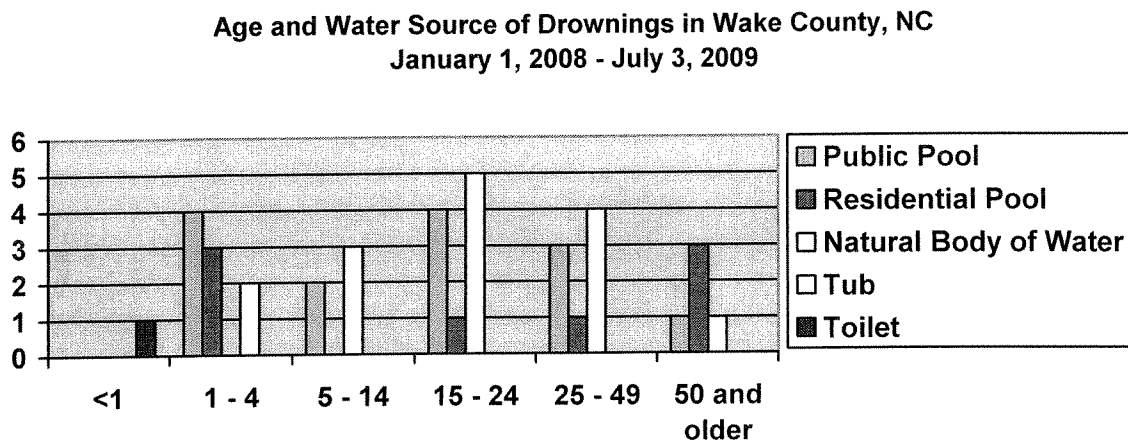


Figure 2 shows what age groups are drowning in which water source. The ages were broken down into the following categories: less than one year of age, ages one to four, ages five to fourteen, ages fifteen to twenty-four, ages twenty five to forty nine and ages fifty and older.

In the category of less than one year of age, the only incident reported was a toilet submersion. Toilet drownings only occurred in this age group. In the category of ages one to four, the highest number of drownings reported occurred in public pools (4), then residential pools (3), and finally tubs accidents (2). This was the only age group that experience tub drownings. Ages five to fourteen only experienced drownings in natural bodies of water (3) and public pools (2). The age group that included fifteen to twenty four year olds, natural bodies of water was the number one source of drownings (5) and public pools were next with four drownings. Residential pools only accounted for one drowning in that age group. Ages twenty five to forty nine also experienced the most drownings in natural bodies of water (4), followed by public pools (3) and then one drowning in a residential pool. Ages 50 and older experienced the most drownings in residential pools (3) and public pools and natural bodies of water each had one drowning.

This information revealed a historical trend that showed any type of targeted intervention to reduce drowning should be multifaceted so each age group would benefit. To answer the third question that seeks to show what measures could have been taken to prevent the drownings in Wake County, each incident was categorized according to age groups. Since infants only had toilet submersion, that should be the focus for that age group to prevent future incidents. Pools, both public and residential posed the greatest risk for children aged one to four, therefore pool safety should be the focus for that age group along with the importance of safety barriers to residential pools. Ages five to forty-nine need an intervention targeted at natural bodies of water, since all three of the age groups in that range experienced the highest rate of drownings in that setting. Public pools in that same age range also experienced drownings in public pools and residential pools, therefore prevention should be incorporated to included those settings as well.

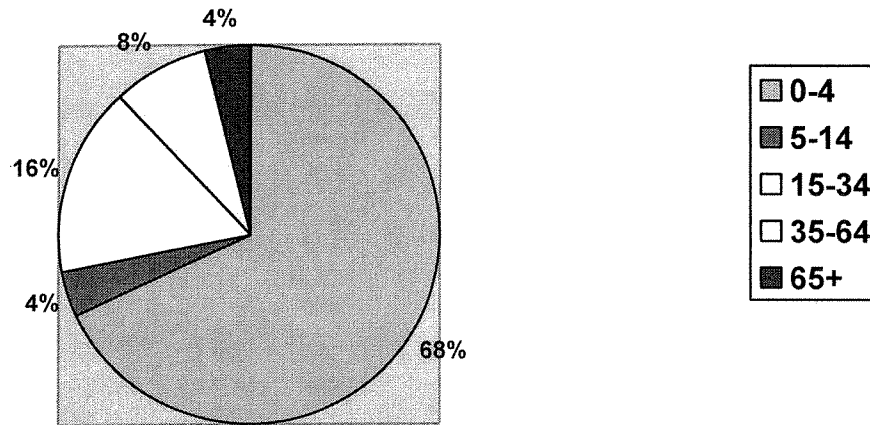
The category for 50 and older showed that residential pools posed the highest risk, thus intervention focused on safety around all water sources is paramount, since the majority of those drownings were subsequent to other health issues.

To answer the fourth question of how effective other fire service agencies have been in reducing the incidents of drowning through their drowning prevention programs, pre- and post-program implementation was researched. Mesa Fire Department (MFD), located in the Phoenix metropolitan area (Maricopa County) implemented a water safety and drowning prevention program in 1999 (Long, M. Interview September 23, 2009). According to Drowning Prevention Coalition of Arizona, the number one cause of deaths of children aged one through four in the state is drowning (Children's Safety Zone, 2009). MFD expanded their program in 2007 when the department hired a Water Safety/CPR Coordinator because four children drowned in three days in Mesa's district (Long, M. Interview September 23, 2009).

Michele Long, Water Safety/CPR Coordinator for MFD, believed the message needed to be updated, had to emphasize adults being proactive and responsible and the message needed a continuous, strong presence within the community. Because of the collaboration between fire departments and hospitals, the department has seen a decline in the number of drownings (Long, M. Interview September 23, 2009). The Children's Safety Zone reports that there were 29 water-related incidents and fatalities in 2007 and 17 in 2008, which shows a significant decrease (Children's Safety Zone 2008). Figure 3 shows information reported by Maricopa County regarding the percentage of water-related incidents in Mesa in 2007, according to age group (Flood, T.J. 2007). The age breakdown shows that children ages 0-4 years have the greatest rate of water-related incidents, which is contradictory to Wake County's findings, where the ages between 5-14 took precedence.

Figure 3.

**Percentage of water-related incidents in Mesa in 2007
according to age group**



MFD has taken a multifaceted approach to decreasing the number of drownings. They have created public service announcements (PSA) that demonstrate how quickly a child can drown and the trauma that plaques that family of the victims. These PSAs can be viewed on MFD's website at <http://www.mesaaz.gov/fire/FLSE/WaterSafety.aspx>. The spokesperson on one of the PSAs was a Council Member in Mesa's district. This cooperation among the political figures and the fire service is paramount for the validity of the prevention program Mesa has implemented.

According to a report issued by Maricopa County (Flood, T.J. 2007), the rates of incidents and deaths in pools have dropped in Maricopa County, with rates for 2007 the second lowest on record. Specific factors that have produced this favorable trend have not been identified, however, awareness campaigns, intense media support in reporting individual incidents, widely publicized prosecution of cases of gross negligence, prompt use of CPR and the impact of pool barrier laws passed during the past decade are all contributing factors (2007).

Discussion

After researching the drowning trends of other communities, it was discovered that there are many variables used in determining the rates of drowning, which leads to inconsistencies across the nation. While one community may define drowning as only occurring if death is the result, other places may include any 9-1-1 call that was reported as a water-related injury, regardless of the disposition of the victim. Until a uniform national system is implemented, the variables will continue to make the compilation of accurate and consistent data difficult.

This ARP presented findings from Wake County that were different from the national averages regarding age-specific incidents. For example, Mesa Fire Department had the highest number of reports in the age group of 0-4 and the lowest rates in the groups from 5-14 and over 65 years (Flood, T.J. 2007). However, Wake County showed results that were opposite of their demographical findings. Wake County's highest rate was among the age group 15-24 years and the lowest was under the age of one. L. Quan and P. Cummings (2003) research revealed rates that were consistent with the findings of this Wake County study, as did research by Brenner, et al (Brenner et al, 2001).

This outcome of this research was not as expected. The national trends were expected to coincide with the local results; however, that was not the result of this study. It was expected that Wake County's highest number of drownings would have occurred in the lowest age group, which would have mirrored the United States' findings. It was also surprising to find that Wake County surpassed the national crude number of drownings per 100,000 people, with 3.2 and 2.82 drownings, respectively.

This ARP put into perspective the importance of preventing drowning in Wake County. The County endures a higher rate of drownings than the national average, which suggests intervention could only help to reduce the occurrences. As the population increases, proactive strategies must be put into place to counter the increases in risk that will result. The fire service must be an integral part of this program for it to be successful, which means resources must allow for an educational campaign targeted at the appropriate age groups. The support of local political figures is also paramount for projecting a collaborative effort, which will foster a greater response from the community.

Recommendations

The purpose of this ARP was to identify trends related to drowning accidents in Wake County so recommendations could be made to reduce the number of drownings. The County can benefit from this research because it was found that the current rate of drowning was significant and could worsen as the population rises, which was the problem that initiated this ARP.

Based on the results of this research, Wake County needs to implement educational campaigns that target specific safety topics related to drowning that are targeted to the appropriate age group. Examples can include PSAs, as Mesa Fire Department implemented, brochures and literature, preschool visits, and start of pool season kickoffs, which encourage constant parental supervision. Boating safety, CPR classes, water-safety classes are also ways to promote safety in the community that can be facilitated by the fire service. Each campaign should focus on the needs of that age group. For example, tub and toilet accidents most commonly occur in the infant age group. Therefore, the fire service could form an alliance with local hospitals to distribute literature about this risk to all parents of newborn babies. Another example of an effective campaign would be to make visits to preschools to teach children about

pool safety. Literature could be placed at all boating stores and marinas that would encourage safe water practices. PSAs could be tailored to any age group, with different messages. If implemented appropriately, these safety campaigns could have a positive outcome for the citizens of Wake County, as well as for the fire service. The presence in the community is always good public relations for the fire service. The goal is to decrease drownings in Wake County by 25% by the year 2012. The decrease in drownings will be an undisputed success.

The issue lies with finding resources to initiate a program. Both monetary and manpower resources will be necessary to effect a successful campaign. Finding the right employee in Wake County to be the facilitator may be difficult. A small group of employees carries out functions of the Fire and Rescue Division of Wake County. Their goal is to protect all of Wake County's citizens. The staff is trained in multiple functions and staff members participate in every program. As of October 2009, there were 19 positions, which included one Fire and Rescue Director, one Fire Marshal, three Chief Deputy Fire Marshal, and fourteen Deputy Fire Marshals (Wake County Fire and Rescue Division Website 2009). These positions range in function by district, shift and area of specialty. Individual fire departments in Wake County range in the number of personnel, apparatus, certifications and response requirements. Many of the larger municipalities have multiple stations and respond to emergency medical service (EMS) calls and are emergency medical technician (EMT) certified. If there is no position that can accommodate the extra time that will be necessary to implement the safety campaign, a new position may have to be created, just as the Mesa Fire Department created a Water Safety/CPR Coordinator. Budgetary adjustments will have to be made.

Further research needs to be done to estimate the costs associated with implementing safety campaigns as recommended by this ARP. To replicate this research for another

community, it is advisable to begin with gathering statistics in your area. A good place to start is with your local EMS or fire service. The Centers for Disease Control offers a database, WISQARS, that was invaluable to this research.

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Appendix A

Call Date	Water Source	Age	Age Units	Outcome
1/4/2008	Pond	8	Years	Refused Treatment/Transport
1/4/2008	Pond	10	Years	Refused Treatment/Transport
1/4/2008	Pond	10	Years	Refused Treatment/Transport
3/29/2008	Lake	39	Years	Emergency Department Transport
4/20/2008	Lake	59	Years	Emergency Department Transport
6/6/2008	Residential Pool	55	Years	Emergency Department Transport
6/9/2008	Public Pool	58	Years	Emergency Department Transport
6/18/2008	Public Pool	4	Years	Emergency Department Transport
6/20/2008	Lake	22	Months	Dead at Scene
6/24/2008	Public Pool	22	Months	Refused Treatment/Transport
7/4/2008	Residential Pool	30	Years	Dead at Scene
7/4/2008	Public Pool	64	Years	Emergency Department Transport
7/5/2008	Lake	23	Years	Dead at Scene
7/9/2008	River	21	Years	Dead at Scene
7/9/2008	River	21	Years	Dead at Scene
7/20/2008	Lake	33	Years	Emergency Department Transport
7/24/2008	Public Pool	3	Years	Emergency Department Transport
7/27/2008	Residential Pool	50	Years	Emergency Department Transport
7/29/2008	Public Pool	23	Years	Emergency Department Transport
8/1/2008	Public Pool	17	Years	Emergency Department Transport
8/1/2008	Lake	44	Years	Emergency Department Transport
8/3/2008	Public Pool	3	Years	Emergency Department Transport
8/4/2008	Residential Pool	44	Years	Emergency Department Transport
8/10/2008	Lake	19	Years	Emergency Department Transport
8/12/2008	Residential Pool	3	Years	Emergency Department Transport
8/16/2008	Residential Pool	19	Years	Emergency Department Transport
11/8/2008	Tub	2	Years	Emergency Department Transport
11/22/2008	Residential Pool	2	Years	Emergency Department Transport
1/31/2009	Tub	18	Months	Emergency Department Transport
2/2/2009	Public Pool	16	Years	Emergency Department Transport
3/6/2009	Pond	36	Years	Emergency Department Transport
3/15/2009	Public Pool	20	Years	Treatment/No Transport
6/6/2009	Residential Pool	24	Months	Emergency Department Transport
6/8/2009	Public Pool	8	Years	Emergency Department Transport
6/10/2009	Public Pool	6	Years	Emergency Department Transport
6/11/2009	Toilet	9	Months	Refused Treatment/Transport
6/18/2009	Public Pool	34	Years	Emergency Department Transport
7/3/2009	Public Pool	39	Years	Emergency Department Transport

Appendix B

Unintentional Injuries by Different Age Groups, US - 2006

	Age Groups										
Rank	<1	1-4	5-9	10-14	15-24	25-34	35-44	45-54	55-64	65+	All Ages
1	Suffocation 843	MV Traffic 471	MV Traffic 515	MV Traffic 703	MV Traffic 10,739	MV Traffic 7,162	Poisoning 7,542	Poisoning 8,234	MV Traffic 4,317	Fall 16,650	MV Traffic 43,664
2	MV Traffic 139	Drowning 458	Drowning 142	Drowning 114	Poisoning 2,936	Poisoning 5,267	MV Traffic 6,470	MV Traffic 6,396	Poisoning 2,415	MV Traffic 6,738	Poisoning 27,531
3	Drowning 51	Fire/burn 202	Fire/burn 118	Other Land Transport 66	Drowning 616	Drowning 436	Fall 628	Fall 1,290	Fall 1,592	Unspecified 4,989	Fall 20,823
4	Fire/burn 28	Suffocation 137	Other Land Transport 50	Fire/burn 64	Other Land Transport 280	Fall 318	Drowning 466	Drowning 491	Fire/burn 467	Suffocation 3,211	Unspecified 6,345
5	Fall 23	Pedestrian, Other 113	Suffocation 50	Suffocation 58	Fall 242	Other Spec., Classifiable 229	Suffocation 318	Fire/burn 463	Suffocation 463	Fire/burn 1,130	Suffocation 5,912
6	Unspecified 19	Fall 38	Other Transport 22	Poisoning 40	Firearm 193	Fire/burn 200	Other Spec., Classifiable 313	Suffocation 470	Unspecifie d 393	Poisoning 1,025	Drowning 3,579

Appendix C

10 Leading Causes of Unintentional Injury Deaths, United States 2006, All Races, Both Sexes

Cause of Death	Number of Deaths	Percentage of All Deaths in Age Group
All Unintentional Injury Deaths	121,599	100.0%
Unintentional MV Traffic	43,664	35.9%
Unintentional Poisoning	27,531	22.6%
Unintentional Fall	20,823	17.1%
Unintentional Unspecified	6,345	5.2%
Unintentional Suffocation	5,912	4.9%
Unintentional Drowning	3,579	2.9%
Unintentional Fire/burn	3,202	2.6%
Unintentional Natural/Environment	1,588	1.3%
Unintentional Other Spec., classifiable	1,492	1.2%
Unintentional Other Land Transport	1,454	1.2%
All Others	6,009	4.9%